To: Dr. Erika Paterson

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Subject: Proposal for Characterizing Water Use During Crop Processing at UBC Farm

**Introduction**

According to the United Nations World Water Development Report in 2015, The agricultural sector accounts for 70% of all freshwater withdrawals globally. Sustainable and efficient water use strategies are becoming an increasingly demanding research topic, attempting to limit agriculture’s water footprint. In order to observe the effect of water use reduction strategies, a water innovations node for UBC’s Campus as a Living Laboratory initiative is set up at UBC Farm.

UBC Farm water innovation node is installed and has been running since June 2019. This node consists of a continuously expanding network of sensors measuring climate, canopy microclimate, soil water content, irrigation water use, and finally, water use at the Harvest Hut where all the crop processing happens. 2019 is the pilot year of the project, so there are many problems to be addressed. Resolving these problems will be essential in ensuring the node is providing accurate data that reflect the complex dynamics of water demand and supply at UBC Farm.

**Statement of Problem**

The biggest problem thus far is the inability to characterize water use during the crop processing phase. Crop processing is a significant black box process for the sensors network as farm operation in washing crops is highly variable. A black box process is a term used to identify systems where its input and output are known, but the system’s internal structure is unknown. Crop processing is a black box process because water flow sensors can identify how much water is being used, but exactly what crop it is used for is unknown to the network. This problem is highly variable because the crop being washed at a station depends on the bi-weekly harvest.

**Proposed Solution**

Multiple solutions are needed to address the two-part problem. The first part of the problem is understanding the usage of the water after leaving the tap. This help answer questions such as “what is the water used for?”. A possible solution for this is to understand the washing processes at the farm. To do this, I would investigate by volunteering to be a part of the washing team for two harvests to familiarize myself with their operation.

The second part of the problem is addressing the human variability in the washing process. This help answer questions such as “is there a pattern in how farmers wash their crops?”. I propose to solve this problem by having multiple meetings with the farm’s processing manager Matt Delumpa. By talking to Mr. Delumpa, I will look into a systematic approach in identifying

where crops are normally washed. Then arrive at a possible solution (i.e. dividing washing area into zones) that works for both the researcher and the farmer.

**Scope**

The purpose of this study is to arrive at a sampling methodology that can accurately reflect the water used in the processing stage for each crop being harvested at UBC Farm. To arrive at this conclusion, I will follow the questions outlined below.

1. What is Mr. Delumpa’s workflow during each harvest from receiving the crop to finished processing? How is water being used in each stage?
2. How do washing procedure differ between crops? Can crops be grouped by their similarity in washing protocol?
3. Is the current data coverage sufficient to observe water being used in each of these stages or does it need to be expanded?

**Methods**

This study will be carried out by interviewing UBC Farm processing manager Matt Delumpa and consulting with my project supervisor Professor Mark Johnson. Professor Johnson leads an Ecohydrology group that is part of the UBC Institute of Resources, Environment, and Sustainability, and he is also the lead principal investigator of this project. Further on-site observations will also be made through being a part of the washing process to observe washing methods employed by the farm. Based on the observations, adjustments to the current data collection system will be ongoing and continuously changing until both parties are satisfied with the new workflow. An example of an adjustment would be addition of sensors or cameras.

**My Qualifications**

I have been involved in this project since the very beginning at the start of 2019. I have assisted in the building of the sensors and our lab-made circuit boards for data collection. I was also involved in the testing and the deployment of the nodes at UBC Farm, so I am familiar with the existing sensor framework and shortcomings of the system being used. I believe my technical skill to work with the sensors and my social skills to work with the farmers can assist in solving the problem of data characterization in a complex and variable human environment.

**Conclusion**

Much work needs to be done for UBC Farm water innovation node to be fully functional. This is a critical step in the quality control of water use data from the node. Uncertainty needs to be limited before using the data for research purposes. It is after this step that a lifecycle analysis of the water footprint for each crop can be performed. This will inevitably lead to exciting research on water conservation strategies in an agricultural setting to ensure long-term water resource availability.